# DIMENSIONS/NBS

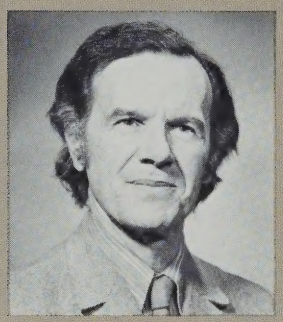
*The magazine of the National Bureau of Standards U.S. Department of Commerce*

*January/February 1979*

Science and Children. See page 12.

# COMMENT

## ON SERVING STATE AND LOCAL GOVERNMENTS



The Federal Government at last count had 779 research and development laboratories that were supported by about 28 billion dollars in public funds in 1979. State and local governments have very few R&D facilities. When technological problems present themselves at these levels, officials turn to their counterparts in other agencies for assistance, or to the private and academic communities.

In this issue of DIMENSIONS, George Linsteadt* discusses one relatively new means of providing support to states and communities: a network of Federal laboratories called the Federal Laboratory Consortium for Technology Transfer (FLC). The FLC works with and through counterpart organizations such as the Urban Consortium, the Urban Technology System, and the Community Technology Innovations Program, all of which are national in scope and are sponsored by the National Science Foundation.

Also involved in this system of technology transfer are regional networks serving communities within a limited area—like the New England Innovations Group, the Southwest Innovations Group, and the Pacific Northwest Innovations Group.

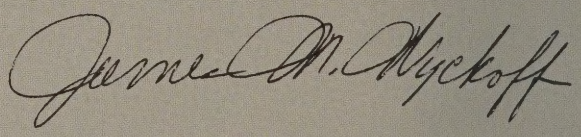
The National Bureau of Standards, as a member of the FLC, cooperates with groups such as these, and also directly with State and city technology transfer agents. Through these and many other avenues, NBS shares its technical knowledge with others who need it.

Among the most "transferrable" areas of research are those dealing with fire safety, energy conservation, building technology, weights and measures, consumer products, and radiation measurements. The pathways for making these technological programs effective for others very often lead through other Federal agencies, through codes and standards committees, and through professional groups.

In order to make NBS resources more widely available, the Bureau has an active program of exhibits at meetings of the major public interest groups: the National Conference of State Legislatures, the National League of Cities, the U.S. Conference of Mayors, and the International City Management Association. Also, working with the Regional Representatives of the Secretary of Commerce and the Department of Commerce's Office of State and Local Government Assistance, the Bureau has participated in the Commerce/Cities Project. Under this program, one city in each Federal region has played host to a team of Department of Commerce (DOC) representatives to plan for a coordinated application of DOC resources to city economic development problems.

The Intergovernmental Personnel Exchange Program discussed on page 9 is yet another means by which NBS can and does cooperate with others to maximize the effectiveness of new technology.

Each of these mechanisms is a conduit for information—flowing in both directions. Through continuing communication, NBS program managers can stay up to date on evolving needs at the State and local levels, and public officials across the Nation can keep up with developments at NBS that might meet some of their technological needs.



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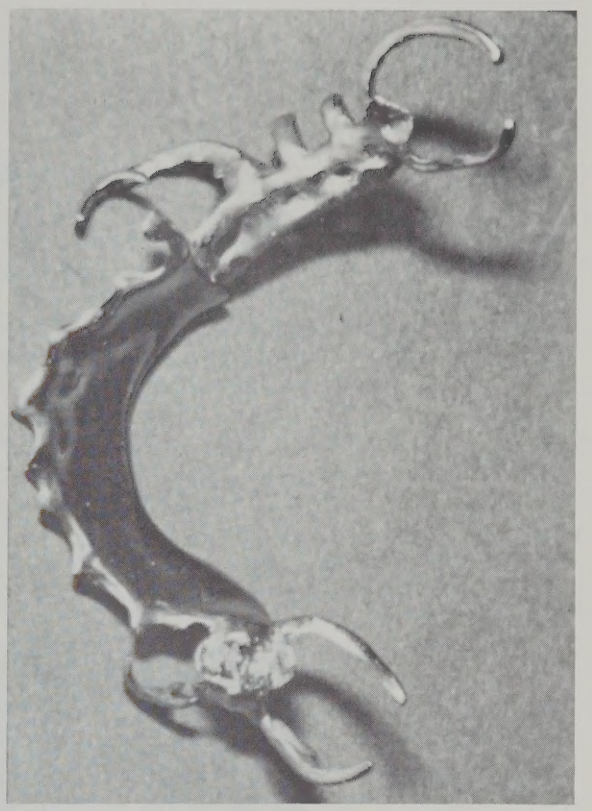

*Titanium alloy dental casting.*

*by Sharon Washburn*

SUCH headlines reflect the economic, political, and social pressures affecting our materials supplies. And, underlying all of this is the fact that natural resources exist only in finite quantities. These realities, plus the incentive to produce better products more economically, keep materials users searching for alternatives.

For example, as the world market price for gold has skyrocketed over the past few years, many dentists have made more and more dental crowns and bridges of nickel-chromium alloys rather than the traditional gold alloys. This solution, however, raises the specter of another problem: What happens if 97 percent of the chromium used yearly in the United States—that portion supplied by Rhodesia and South Africa—becomes unavailable or overly expensive?

Faced with such possibilities, dental researchers continue to search for other candidate materials. Dr. Richard Waterstrat, an American Dental Association research associate at the National Bureau of Standards, thinks that he may have found a promising alternative. Waterstrat has made and begun to test what he believes to be the first dental appliances cast from a titanium-based alloy.

If an already completed preliminary investigation is any indication, "Titanium alloys as dental materials will increase the options open to the dentist and the patient," says Waterstrat. "They are strong, lightweight, have good corrosion resistance, and they are well tolerated by body tissues."

Far from last is the advantage of availability. The ores are abundantly distributed throughout the United States and the rest of the Western Hemisphere.

Although titanium alloys have been used in medical implants, such as hip joint replacements, for a number of years, dental experts thought they would be very difficult to form into the intricate shapes required for dental appliances. "Titanium has been largely ignored for very good reasons," explains Waterstrat. "It melts at nearly 1700 °C, and when melted, it reacts chemically with just about everything. Generally, it can't be melted in an ordinary crucible. Melting has to be done under a vacuum. All of this has pretty well ruled out titanium in the past."

However, recent research in the aerospace industry has led to the development of titanium alloys with lower melting points, which makes it possible to fabricate titanium dental appliances using conventional casting techniques.

"While I was thinking about the problem of finding new alloys for dental applications, I at-

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*Washburn is a writer and public information specialist in the NBS Public Information Division.*

tended a metallurgical society conference where I heard Don Schuyler of the AiResearch Manufacturing Company discuss a low melting titanium alloy that his company had developed in collaboration with Reactive Metals Inc.," Waterstrat recalls. "This alloy, which melts at about 1430 °C, appeared to have practically all the physical properties needed in a dental alloy."

After some experimentation, Waterstrat, with Schuyler's assistance, found that the alloy—87 percent titanium and 13 percent copper—could be cast using a conventional dental casting machine with minor modifications. To minimize chemical reactions between the alloy and the crucible or air, the researchers injected argon gas into a carbon-lined crucible through a simple, loose-fitting ceramic cover.

In this procedure, chemical reactions between the air or the crucible caused no problems, and the metal flowed unimpeded into the mold. According to Waterstrat, the molten metal appears to possess a high fluidity, which helps produce sound castings with sharp detail. The titanium alloy has mechanical properties comparable to those of cobalt-chromium or nickel-chromium alloys that are already used in cast dental appliances.

And, says Waterstrat, "Further advantages may be revealed as the properties of this material are more fully explored." □

*Waterstrat at NBS with dental casting machine.*

# Frontiers of Measurement Science

*Blas Cabrera, left, and C. W. Francis Everitt, Stanford University researchers, examine a special bearing assembly used in their experiments to determine precise values of physical constants such as the Planck's constant/electron rest mass ratio.*

*by Michael Baum*

TWO groups of researchers with unique projects to study some of the fundamental constants of physics and probe the creation of the universe have been named recipients of awards under the Precision Measurement Grants Program of the National Bureau of Standards.

The two $25 000 grants for 1979 were awarded to C. W. Francis Everitt of Stanford University for a new determination of the ratio of Planck's constant to the rest mass of the electron ($h/m_e$), and to Rogers C. Ritter of the University of Virginia for the construction of a nearly frictionless mechanical rotator that, among other things, may be capable of detecting the continuing creation of the universe.

Since 1970, NBS Precision Measurement Grants have been awarded each year to scientists in the colleges and universities engaged in fundamental research involving precision measurement such as is required in the determination of basic physical constants. The grants, which may be renewed for an additional two years, often do not provide full funding for any one project, but rather encourage researchers to pursue those aspects of their work that involve precision measurements which would otherwise be ignored.

The $h/m_e$ experiment, which is being conducted by Everitt and Blas Cabrera with other colleagues from Stanford, takes advantage of the macroscopic quantum properties of a superconducting ring of known cross-sectional area. Rotating the ring and measuring the angular frequencies corresponding to nulls in the magnetic field through the ring will allow the researchers to determine directly the $h/m_e$ ratio.

Quantities such as Planck's constant, which relates the energy of a photon to its frequency, and the electron rest mass are among the fundamental physical constants. Accurate measurements of such ratios enable physicists to test the present formulation of the laws of physics. An improved value for $h/m_e$ will also contribute to an improved knowledge of the fine structure constant, which enters into equations of quantum electrodynamics—to date the most accurately tested equations of physics.

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*Baum is a writer and public information specialist in the NBS Public Information Division.*

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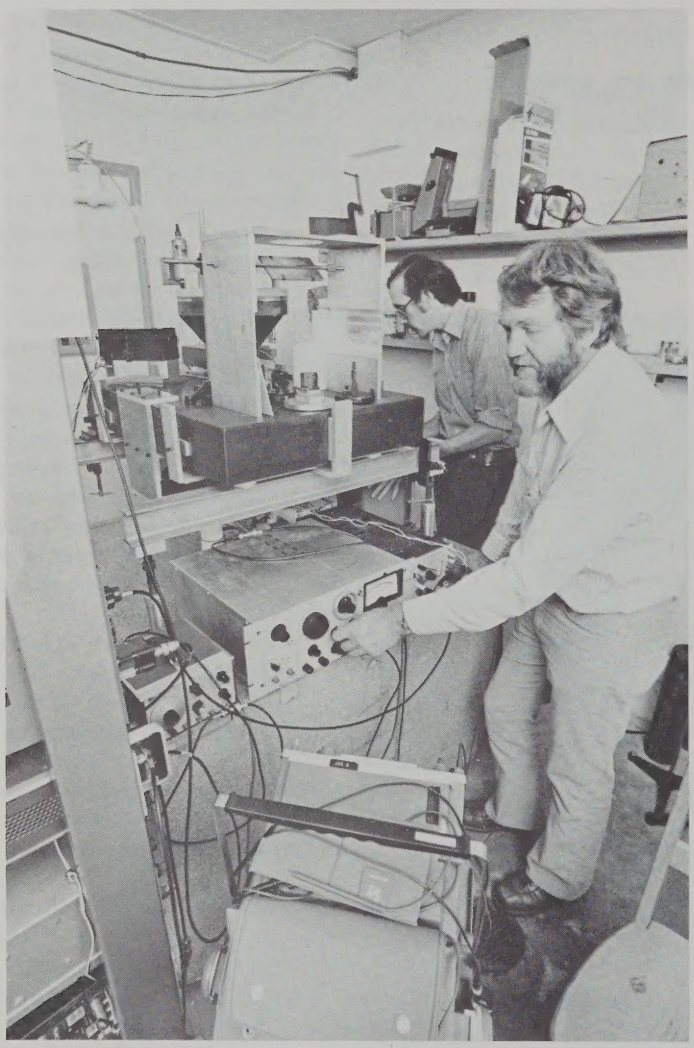
*Rogers Ritter, front, and George Gillies, University of Virginia researchers, make adjustments on the laser Doppler interferometer system used to measure the angular speed of an ultra-precision turntable. The turntable, which is used in several relativity experiments, is mounted in the center of the block granite surface plate.*



The investigators ultimately hope to achieve a precision in the measurement between one and ten parts in ten million (an improvement of 100 to 1000 over the best previous direct determination of $h/m_e$). Related measurements will be made to determine the special relativistic corrections to the electron mass. The exact effect that relativity has on the electron mass is still a matter of conjecture. The Stanford experiment will be the first measurement in the solid state system sensitive enough to see relativistic phenomena.

The experiment being pursued at the University of Virginia by Ritter and his associates also depends on rotating objects, in this case two ceramic glass cylinders, one inside the other, rotating on a precision turntable. The inner cylinder is suspended magnetically to reduce friction and rotates freely within the outer cylinder which rests on the turntable. The arrangement reduces friction between the cylinders to the point where, according to the University of Virginia scientists, theory predicts that once the inner cylinder is set spinning it won't stop for 100 billion years.

Such a precision mechanical rotator has many uses in experimental physics—as an extremely precise mechanical clock, for example, or as a means of measuring whether or not Newton's gravitational constant varies with time.

One of the most intriguing proposals, however, is to use the instrument to test the dynamic mass creation theory of the universe, which holds that mass is being constantly created in the universe, but at a rate so slow that it is not ordinarily noticed. (One estimate is a rate no greater than $4 \times 10^{-23}$ grams per gram per second. A mass like the earth would produce less than 240 kilograms of new mass per second.)

Such a creation of mass, however, might be detectable as an otherwise unexplained slowing of the carefully shielded inner cylinder. If this effect is demonstrated, the result will have a profound effect on theories of the cosmos.

Those interested in the Precision Measurement Grant program can obtain further information from Dr. Barry N. Taylor, Electrical Measurements and Standards Division, National Bureau of Standards, Washington, D.C. 20234. □

# Getting Federal Research to the Grass Roots

*by George F. Lindsteadt*

DECEMBER 23, 1975, Seattle, Washington—A patrolman enters a store where he is working as a security guard during his off-duty hours and walks in on a hold-up in progress. He is shot once in the chest, but is only momentarily stunned. The amazed robber shoots again, but the officer still appears unhurt. In desperation, the robber shoots twice more. This time the policeman is hit in the hand and the side of the head, but he recovers from relatively minor wounds in 72 hours.

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*Lindsteadt is chairman of the Federal Laboratory Consortium for Technology Transfer. The address is FLC Secretariat, Code 3803, Naval Weapons Center, China Lake, CA 93555.*

*Ralph Gorden of the NBS Law Enforcement Standards Laboratory holds a lightweight protective vest. NBS used the apparatus in the foreground in developing a standard test method to insure the reliability of this type of body armor.*

When apprehended by other officers, the still confused criminal reportedly blurts out, "That [expletive deleted] must change clothes in a phone booth!"

Actually, the police officer's secret was a special type of soft body armor which is only about one centimeter thick and is worn under his regular uniform. His protective vest was made by a private armor manufacturer, but the specifications that went into its design were provided by scientific laboratories of the Federal Government. Prior to an effort headed by the Army's Edgewood Arsenal in Maryland, such lightweight vests did not exist.

But even when technology needed to solve specific problems has been available in Federal laboratories, it has not always been easily accessible to those who need it. To transfer Federal technology to the grass roots, there must be a link, a way to connect those who have the problem with those who have the solution. And today there is.

A network of Federal research organizations called the Federal Laboratory Consortium for Technology Transfer (FLC) was established in 1974. The main mission of this consortium is to maximize the use of new technology developed in government labs. In addition, the FLC collects and disseminates information about technology transfer techniques as an aid to policy makers.

In the case of body armor, the consortium supplied the contacts needed to transfer the Army's technical skill in protective vest design to city police departments across the country. The effort began in San Diego following the passage of a new California bill requiring all law enforcement personnel to wear protective vests. Prompted by the proposed legislation, the San Diego Police Department contacted Gerald Miller, an FLC coordinator on loan from the Naval Ocean Systems Center to the city and county of San Diego. The department needed technical information on soft body armor other than that provided by vendors.

As an FLC representative, Miller was familiar with the Army's research in this area. In 1973, the Justice Department's Law Enforcement Assistance Administration (LEAA) had asked the Army to look into the possibility of developing a comfortable protective vest that could be worn by public officials. The program to develop this body armor involved several Federal laboratories including the Army's Edgewood Arsenal (Chemical System Laboratory), Natick Research and Development Center, and the National Bureau of Standards. The Aerospace, MITRE, and DuPont corporations, along with the Federal

# NBS and the Federal Laboratory Consortium

*by James Wyckoff*

In February 1978 the National Bureau of Standards joined the Federal Laboratory Consortium for Technology Transfer. At that time, Dr. Jordan Baruch, Assistant Secretary for Science and Technology in the Department of Commerce, said: "I am glad to see this increased level of commitment to the consortium. The Federal labs have so much to offer our industrial and intergovernmental constituents. I also look on the consortium as a valuable channel for feeding information back into our own planning process to make our programs increasingly relevant to the widespread needs of these groups."

The Bureau already has many contacts with these groups, but the consortium represents a new way of working with other Federal labs in the process. The following projects are typical of NBS consortium activities:

- The Bureau participated with the Delmarva Advisory Council in a workshop on technological information resources for libraries. The Bureau's librarian was able to contribute significantly to a panel which included representatives from the Navy and the National Aeronautics and Space Administration. Visits to NBS helped the Delmarva Technical and Community College plan for a computer terminal to tap existing technology data bases.
- A new group of State inspectors from Kentucky consulted with Bureau fire and building experts on standards for reducing risks in public buildings.
- NBS provided metric conversion information for planners in San Diego and Seattle; similarly, a number of studies relating to energy conservation in buildings were made available.

The contacts between Federal labs can have equally impressive payoffs. Recently, scientists at the Harry Diamond Labs of the Department of Defense invented a new type of thermometer for measuring high temperatures: Measurements of temperature are made by monitoring the pressure of gases flowing through thin ceramic tubes. When they had problems with the ceramics under very high temperatures, they turned to their technology transfer representative for contacts in other labs. Through FLC channels, experts in chemical, mechanical, and thermal properties of ceramics were reached at NBS. HDL scientists reported that "nine months of work were saved by one morning of phone calls." In turn, NBS scientists anticipate that the invention may provide a valuable new technique for their high temperature measurements.

The Bureau looks forward to playing host to the consortium at its May 1979 meeting in Gaithersburg.

*Wyckoff is NBS liaison officer, State and Local Government Affairs.*

Bureau of Investigation, the International Association Chiefs of Police, and others were also involved. The end product was the first lightweight armor which is both highly protective and comfortable to wear.

As a result of the contact made by Miller, the San Diego Police Department was provided with reports, consultation, and even a personal visit by an Army armor expert who had been involved with the LEAA project. Purchase specifications were drawn up which combined the optimum mix of protection and wearing comfort. The cost to the city for this technical help—nothing. The specifications have now been sent to almost 50 additional city police departments.

A number of reports have been written concerning the role of the Federal laboratories in providing such technical assistance. For example, the Committee on Federal Laboratories of the Federal Council

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on Science and Technology recommended in a 1974 report that existing Federal research be used to help solve "urgent national needs" in the areas of environment, transportation, and health. More recently, Congress passed the National Science and Technology Policy Organization and Priorities Act of 1976. This act specifically directs the Federal Government to use its resources in engineering personnel and research to maximize the application of Federal R&D results to civilian needs.

An organization like the FLC which draws together the resources of over 180 Federal research and development laboratories and centers is an effective way of accomplishing this technology transfer with only a small additional investment.

Each of the laboratories in the system provides its own representatives to the consortium. The representatives meet twice each year to discuss technology transfer and to identify new technical information which should be made available at the State and local level.

The FLC was patterned after the earlier Department of Defense (DOD) Technology Transfer Laboratory Consortium. Through a cooperative agreement between 11 DOD laboratories and the National Science Foundation (NSF), a technology transfer liaison service was set up in 1971 to find civilian uses for military research results. Emphasis was mainly on promoting ties between DOD and laboratories in other agencies.

Three years later, the success of technology transfer efforts prompted DOD to invite the major Federal R&D laboratories and centers to join in the Consortium and thus the FLC was established.

The National Science Foundation's Federal Laboratory Program is responsible for the operation and support of the FLC. Through grant resources, the NSF established an FLC Secretariat at the Naval Weapons Center, China Lake, California, to assure effective communication between consortium members. This secretariat is part of the Naval Center's Technology Utilization Office. Responsibilities include direct support to the NSF Federal Laboratory Program Manager to expand, organize, and develop the capacity of the FLC and to provide funds and/or services to consortium members for technical assistance.

Like the FLC, the objective of the Federal Laboratory Program is to make publicly funded R&D resources widely available on a cost-effective and timely basis. Special emphasis is given to problems associated with intergovernmental use of Federal laboratories and centers.

A directory of current research within the FLC laboratory system is available to public and private users by contacting the FLC Secretariat's Office at China Lake.* In turn, user requirements are distributed to all FLC representatives via a monthly newsletter. Organizations should contact a regional FLC representative or the FLC Secretariat to have requests for Federal technical assistance listed in the newsletter.

Much of the success of technology transfer efforts depends on the person-to-person contacts developed between State and local governments, the private sector, and Federal laboratories. Under the provisions of the Intergovernmental Personnel Act (see (box), the FLC has placed a number of Federal employees in positions to assist individual and cooperative State and local organizations. These assignments have proven highly successful.

The following IPA assignments are typical of the types of requests that have been filled through the FLC:

- An electronics engineer has been selected under the Naval Underwater Systems Center's Technology Transfer Program to serve as staff scientist to the Connecticut General Assembly's Office of Legislative Research. The main objective of the program is to develop techniques for providing scientific and technical information to State legislators and to promote greater cooperation between the scientific and technical community and the State legislature.
- An IPA assignment to the Rhode Island League of Cities and Towns is providing technical assistance in developing a public works management program for four cities in the League.
- An FLC assignment to the State of Oregon provided a science advisor for the city and State agencies as well as the legislature and the governor of Oregon. Assistance has been provided to over 40 cities. The city of Portland, with help from the IPA assignee, established its own science advisor office.
- At the San Diego Technology Action Center, an IPA assigned science advisor has established a technology transfer program for both the city and county of San Diego.

The FLC also has coordinated hundreds of technology transfer projects like those described below which were designed to solve specific problems:

- **The National Bureau of Standards provided the Environmental Protection Agency with highly accurate in-**

** The address is given in the footnote on page 8.*

## Intergovernmental Personnel Act

The Intergovernmental Personnel Act of 1970 allows the temporary exchange of personnel between Federal executive agencies and States, local governments, institutions of higher education, and Indian tribal governments for work of mutual concern and benefit. Every major Federal agency, all 50 States, over 300 local governments, and more than 350 colleges and universities have made use of the program since its inception.

The number of IPA assignments made has increased in each year of the seven years the program has been in operation. To date over 6000 assignments have been made. In FY 1978 alone over 1100 placements were completed.

IPA participants represent a variety of backgrounds and skills; however, most assignments are in the areas of general executive management, science and technology, education, social science, business, law, engineering, and architecture.

An individual placed in an IPA assignment remains an employee of the sponsoring organization. Other considerations such as fringe benefits, travel, and length of the assignment are negotiated between the two participating agencies. Assignments are made for a minimum of 30 days and a maximum of two years with the possibility of extensions of up to two additional years.

For information on IPA assignments available at NBS contact James Wyckoff, Liaison Officer, State and Local Governmental Affairs, National Bureau of Standards, Washington, D.C. 20234. Phone: 301/921-3814.

struments for measuring electromagnetic radiation. The instruments were needed to measure radiation levels on Mt. Wilson near Los Angeles and determine if levels were high enough to require the closing of a local post office. When Portland, Oregon, was faced with a similar problem, reports of the Mt. Wilson Study were sent to them.

- Sandia Laboratories provided a local community in New Mexico with technical assistance in the use of thermal radiation to treat city sewage. This process converts the sewage into safe fertilizer or a high protein animal feed stock.
- Technology developed by the Army's Night Vision and Electro-Optics Laboratory has been used to assist the Treasury Department in border raids which resulted in the seizure of $19 million worth of narcotics in one year, detect illegal aliens, restore vision of patients in the early stages of night blindness, prevent animal poaching, and study animal behavior.
- The city of San Jose, California, has used knowledge from a course taught at the Lawrence Livermore Laboratory in microcomputers to design traffic control equipment which will save them an estimated $175 000.
- The Naval Ship R&D Center has assisted the State of Alaska in determining a practical method of transporting school children over frozen tundra.
- The Lawrence Berkeley Laboratory (Department of Energy) has developed computerized census data for State and local community use. This information is available through Marvin Wilson at the National Technical Information Service (NTIS), U.S. Dept. of Commerce, Springfield, Va. 22161. Phone: 703/557-4610.
- A technology transfer coordinator assigned to the State of Oregon from the Naval Ocean Systems Center suggested the use of an automatic transmission kit which has been used by at least six police departments in the State to improve vehicle gas mileage by up to 20 percent.

The problems of addressing the complex needs of our society are self evident. It is also clear that a large portion of the technology required to solve those problems already exists. It needs only to be appropriately transferred and applied. The Federal Laboratory Consortium attempts to support these goals on an active, person-to-person basis—for maximum benefit. □

**"The part Margie hated most was the slot where she had to put homework and test papers. She always had to write them out in a punch code they made her learn when she was 6 years old, and the mechanical teacher calculated the mark in no time."***

# Seeing the Human Side of Science

COVER STORY

*by Susan Lieberman*

MARGIE is the product of writer Isaac Asimov's imagination. In her technologically advanced environment, mechanical teachers had entirely replaced the flesh and blood variety—a chilling bit of science fiction to be sure.

Yet, in our present, technologically advanced society, many schools do employ a variety of "mechanical teachers." Children often manipulate machines programmed to impart reading, math, and foreign language skills. Does this mean that today's science and technology have dehumanized learning? Hardly. Schools use teaching machines to enhance classroom activities, not to replace flesh and blood teachers.

The teacher is as alive as ever because teaching is basically a human enterprise. And so is science, although students may see it only as something they study, not something people do. Is it important for children to see the human side of science?

A number of researchers at the National Bureau of Standards believe that it is, and they are translating their belief into actions.

NBS Mathematician Patsy Saunders arrived at Fields Road Elementary School in Gaithersburg, Maryland, carrying a large, heavy suitcase. After telling a group of fourth, fifth, and sixth graders about different computer languages, she opened the suitcase to reveal a portable computer terminal. She explained how the terminal works while dialing into the computer at NBS. The students pushed forward, crying, "Me first. Let me try it."

Saunders was visiting the school as a part of a cooperative pilot program between the NBS/Gaithersburg laboratories and the Montgomery County (Maryland) Public Schools. The focus of the program, and a similar one administered at the Boulder, Colorado, laboratories of NBS, is to enrich the learning experiences of children through direct contact with people who "do" science. Scientists conduct demonstrations and experiments in their laboratories for high school students and in the classrooms for elementary school students.

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*Lieberman is a writer and public information specialist in the NBS Public Information Division.*

** "The Fun They Had," a story by Isaac Asimov.*

*Engineer James Hill of the NBS Center for Building Technology shows students a solar collector at NBS, top, and explains solar energy programs during a classroom visit.*

The children who participate in these programs are exposed to a wide variety of scientific research —basic and applied—from measurement standards and biomechanics to cryogenics and laser spectroscopy. Often it's a hands-on experience for the fourth through twelfth graders, whose teachers may also supplement the presentations with other classroom activities. One group of fifth and sixth graders built solar reflectors in preparation for the scientist's presentation on solar energy.

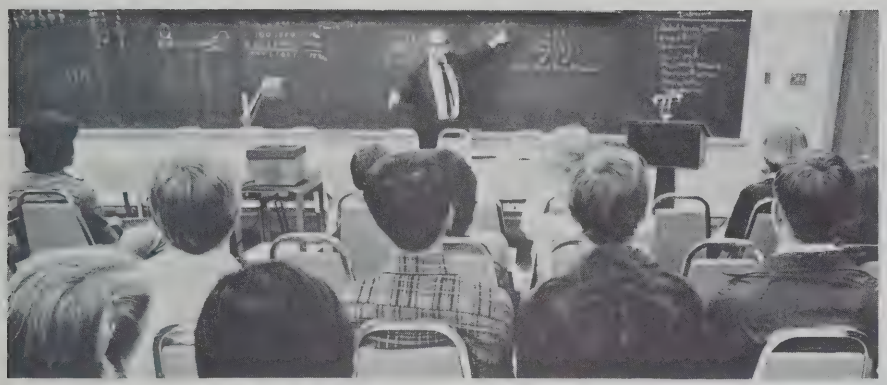
It's important to involve students in the presentations early. That's what NBS Mechanical Engineer Robert Berger learned. Berger has been developing

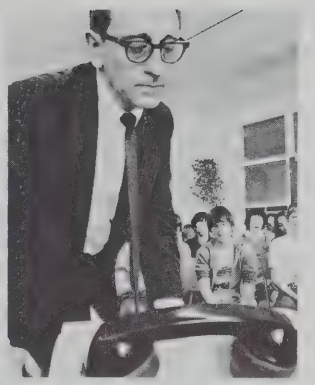
*The Equal Employment Opportunity Committee at the NBS-Boulder, Colorado, laboratory is exploring new ways for researchers to participate in public school science and mathematics programs.*

test methods to determine the safety of toy projectiles. At one demonstration, he had students shoot the projectiles into their hands. "I set up a game with one of the last groups I spoke with. The kids played with the toys and tried to decide which ones were the most dangerous. Because they were involved from the beginning, I think they got more out of the presentation than the students who tried out the toys after the lecture."

Although the programs in Gaithersburg and Boulder share similar goals and offer similar resources, their histories are quite different.

In 1976, the Equal Employment Opportunity Committee in Boulder created a community outreach





*Mathematician Russell Kirsch of the NBS Center for Applied Mathematics enhances his discussion of computers by bringing a computer terminal to class.*

program. It grew out of an earlier on-the-job training project that enabled 14 junior high students to spend time with scientists in their labs. The rural and mountain areas surrounding the Denver-Boulder metropolitan area provided little exposure to science before NBS turned itself into a community resource.

The committee has set goals of interacting with ten schools during this academic year (up from five last year) and of exploring new ways for NBS researchers to participate in public school science and mathematics curricula and career education programs.

In Maryland, a group of parents seeking new challenges for their academically oriented children approached the Montgomery County Public Schools (MCPS) and the National Bureau of Standards in 1977. A Science and Technology Enrichment Program (STEP) cosponsored by NBS and MCPS evolved from those initial contacts. In the 1977-78 school year, 12 schools, 400 students, and 15 researchers participated in STEP. This school year STEP, like its counterpart in Boulder, has expanded. It now involves 18 schools in Montgomery County.

Many of the staff involved in these programs hope that direct exposure to scientists and their work will encourage some students to think in terms of a career in science. If children begin to see scientists as real people, they may also begin to see themselves "doing" science. Since relatively few women and minorities pursue careers in science and engineering, plans are being made in STEP for future seminars directed especially at girls and minorities.

"We need to present role models for women, blacks, and other minorities," says Laser Chemist Ilan Chabay. "Scientists don't fit into a mold; you make your own mold and still do science."

This, perhaps, is the most important lesson of all. □

## FOR SCHOOLS EVERYWHERE

The National Bureau of Standards is a resource for schools across the Nation. Teachers are urged to inquire about films and printed materials for elementary grades and up. For information about educational programs, contact Special Activities, NBS, Administration Building A640, Washington, D.C. 20234; telephone: 301/921-2721. A list of NBS publications that might be of interest to teachers and students is available from the NBS Inquiry Service, Administration Building A617, Washington, D.C. 20234; telephone: 301/921-2318.

## GOVERNMENT AND INDUSTRY OFFICIALS DISCUSS EMI PROBLEMS

*by Frederick P. McGehan*

Imagine depressing the lever on your toaster and getting music and news from a local radio station.

Or, stepping on the accelerator of your $15 000 sports car only to have it stall out because your car has electronic fuel injection and someone alongside you is broadcasting on his CB radio.

Or, being a patient in a hospital's intensive care unit and discovering that electronic life-support equipment is being interfered with by the hospital's system for paging doctors.

Or, activating a hand-held two-way radio and seeing the automated equipment of a huge oil refinery being shut down for the rest of the day—at a cost of hundreds of thousands of dollars to clean up and restore production.

These tales and others were told at the National Bureau of Standards' second annual Workshop on Electromagnetic Interference (EMI). The Workshop was held November 2 and 3 at NBS headquarters at Gaithersburg, Maryland, and attracted 200 participants from government agencies and private industry.

Electromagnetic interference, primarily in the radio and microwave ranges of the spectrum, is becoming more common as the sources of radio and microwave emissions increase and as more electronic products—including such things as home computers—come on the market. Conference participants noted that currently there is no plan to insure the electromagnetic compatibility of consumer electronic products.

Microprocessor technology has become a "status symbol," said Chris M. Kendall, a private EMI consultant from Running Springs, California, and a principal speaker at the workshop. "Everything has to have a microprocessor even if it doesn't need it," he told a workshop plenary session.

Kendall warned that the United States is on the threshold of an electronics revolution and today's EMI problems will pale beside those to be encountered in the 1980's.

On the subject of biological effects of electromagnetic radiation, Don R. Justesen of the Veterans Administration Hospital, Kansas City, Missouri, said there are two "warring parties" of scientists: Those who believe there are no biological consequences other than thermal (heating) effects, and those who believe that long-term low-level exposure to electromagnetic radiation poses hazards to organisms, including man. Justesen, head of the neuropsychology and behavioral radiology laboratories at the VA hospital, noted that organisms are sensitive to the earth's natural electrical and magnetic fields (birds use the magnetic field to navigate) and that artificial sources of electromagnetic energy "could" interfere with biological systems. He called for further study in this area.

After plenary sessions, the participants broke into five separate groups for intensive discussions of EMI problems in the areas of communications, transportation, consumer products, industry, and medicine.

At a closing session, discussion leaders generally agreed that more data are needed to better define the electromagnetic environment and the susceptibility of electronic products placed in that environment. They cited needs for improved public education about EMI and for improved product design standards, preferably voluntary, to prevent EMI. They discussed whether it would be possible—or even desirable—to reduce the intensity and/or frequency of use of electromagnetic signals in order to minimize EMI.

The discussion leaders also cited the need for a central government agency to coordinate the many aspects of the EMI problem. At present, nine Federal agencies are responsible for various aspects of EMI.

Charles K. S. Miller, workshop chairman and leader of NBS' EMI/Radiation Hazards Program based in Boulder, Colorado, termed the workshop a "striking success" and said he's planning another meeting next year.

This was the second year that NBS has sponsored a workshop on electromagnetic interference. The Bureau's role is to help other government agencies and private industry in measuring the electromagnetic environment.

*McGehan is a public information specialist with the NBS Boulder Program Information Office.*

## NEW METHOD FOR ASSESSING BUILDING CODE BENEFITS AND COSTS

by Mat Heyman

A new approach for evaluating the potential benefits and costs of building code provisions has been developed by the National Bureau of Standards. Based on traditional benefit-cost techniques, the method is expected to help building regulatory officials, legislators, and other decision makers assess the impact of changes in specific building codes.

There has been a long-standing debate over the effect of building codes on technological innovation and construction costs. Some experts contend that codes tend to promote inefficiency and higher building costs, while others insist that these negative effects are relatively small.

The approach described in a report issued recently by NBS, *An Economic Analysis of Building Code Impacts: A Suggested Approach,* is suggested as one tool that may help resolve that conflict on a case-by-case basis by providing more detailed information about potential impacts.

*Heyman is a writer and public information specialist in the NBS Public Information Division.*

The particular benefit-cost assessment method for building code analysis was developed by Dr. John S. McConnaughey, Jr., in the NBS Center for Building Technology's Applied Economics Program. To illustrate the technique, McConnaughey analyzed the 1975 National Electrical Code requirement for ground fault circuit interrupters in residences. These devices are designed to protect building occupants against electric shock. The report estimates that the cost to save one life through the use of this device is nearly $4 million.

The six-step approach presented in the report is intended to be used primarily to evaluate a proposed change in an existing building code and to help assess whether it is desirable to accept or reject the change. It can also help assess "how much" of a particular type of code protection is desirable or rank the desirability of a number of proposed building code changes. Each step in the methodology is explicit, and assumptions are to be clearly spelled out in the analysis process.

As efforts to reform and improve the regulatory process have increased, so has the need for widely accepted definitions and for a classification system that can be used as a framework for understanding and investigating building code impacts. The NBS report provides suitable definitions, as well as this classification system, so those seeking to reform building codes will have a common basis for discussion.

According to NBS' McConnaughey, "The approach spelled out in this report has been designed to use information that is already available or easily obtainable. Even so, this methodology will not be applicable to every single code provision, nor does the report imply that after an evaluation is made, all concerned parties will agree about whether or not a building code change should be adopted." It is assumed, however, that more complete benefit and cost information will lead to better public decisions, and McConnaughey says that this approach "should help those who are making those decisions."

The NBS report, *An Economic Analysis of Building Code Impacts: A Suggested Approach* (NBSIR 78-1528), is available for $5.25 from the National Technical Information Service, Springfield, Virginia 22151. Order by PB #287 405.

# STAFF REPORTS



## PREDICTING MATERIALS PROPERTIES OF POLYMERS

*A researcher at the National Bureau of Standards is using small angle neutron scattering to determine a reliable model for relating microscopic structure to materials properties of certain polymers; a validated model of rubber elasticity could pave the way for other advances in polymer science and technology, possibly including a better basis for selecting materials for an application.*

*Charles C. Han, Polymer Science and Standards Division, B226 Polymers Building, 301/921-3251.*

Because hydrogen and deuterium have radically different scattering lengths, hydrogenated and deuterated polymer molecules can have very different coherent scattering cross-sections for neutrons. This difference is analogous to having two different colored molecules, either one of which can be studied by subtracting a background which matches the color of the other molecule. Using slow neutrons (with a wavelength of $\sim$0.5 nm) and going to smaller scattering angles $\theta < 5°$), one can measure correlation distances of about (0.5 to 100 nm), which is in the range of single molecular dimensions of polymers.

Therefore, the small angle neutron scattering (SANS) technique has naturally become an ideal tool for studying spatial distribution of a single isotopically labeled polymer chain which is embedded in a physically identical environment.

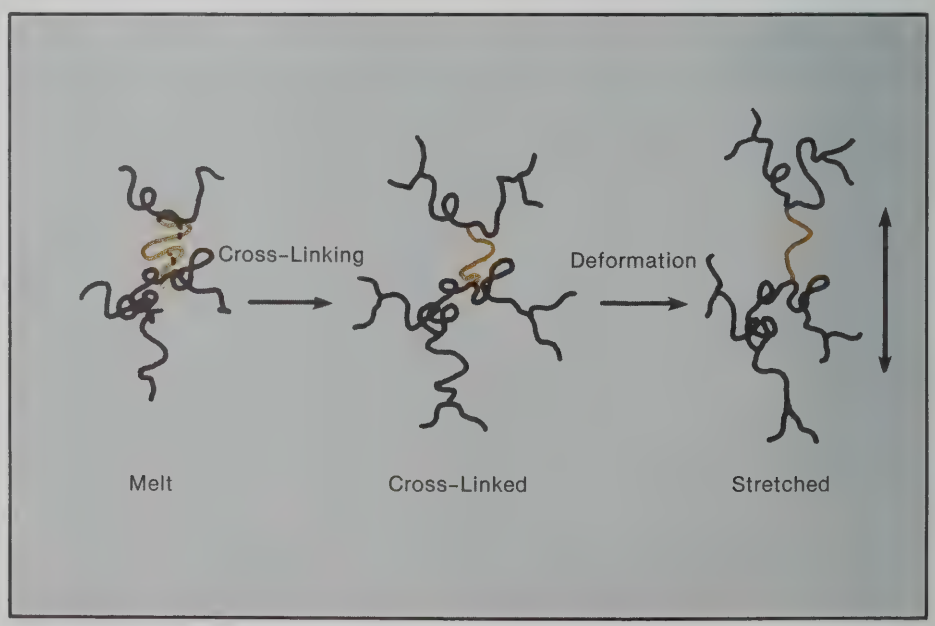
We have used this technique to study an important class of polymeric materials —rubber. Rubber is formed by interconnecting high polymer molecules into a network. These long chain polymer molecules assume conformations which would fit a "random walk" distribution in the bulk state (melt) and presumably in the cross-linked network state also. Since the polymer conformation is statistical, following a random or Gaussian distribution, there are a large number of possible conformations for a given random coil—and therefore a large associated entropy. Stretching the polymer chain results in a decrease in the number of possible conformations, with a corresponding decrease in entropy.

This can be easily seen if a polymer chain has been stretched completely into a straight line. When the external stress is released, the polymer chain will randomize itself, release the stored potential energy, and again assume a random-coil conformation that has a shorter macroscopic dimension in the previously strained direction. This behavior, which is contrary to that of other materials, demonstrates the principal mechanism by which rubber stores energy, and the reason why the polymer chain between connecting points in the network can be thought of as an entropy "spring."

We have prepared a series of end-linked polybutadiene (PB) rubber networks, with approximately equal chain lengths between crosslinking points and also with a few ($\leq$ 3%) deuterated chains incorporated. Using the SANS facility at the NBS reactor, we were able to study these samples and examine the relation between microscopic chain conformation and macroscopic material deformation.

In Figure 1, we illustrate the two stages of the experiment graphically. First, we prepare a bulk mixture of PB with a few deuterated (dPB) chains embedded.

**Figure 1**—*The two stages of the first experiment. Stage 1: Polymer chains before and after cross-linking are compared. In this case, the functionality is three (every 3 chains are linked together at ends). The chain in color is deuterated. Stage 2: Polymer chains before and after deformation are compared.*



As we mentioned before, the scattering due to a dPB molecule can be extracted by a difference measurement. Comparisons are made of the radius of gyration (which is related to its overall dimension) of a polymer molecule and the scattering profile as a function of scattering wave vector **q** (which is related to wavelength and scattering angle). Such comparisons allow us to determine whether or not the polymer chain maintains its random coil conformation and dimension upon crosslinking at its ends.

In Figure 2, we show a plot of scattered intensity from a deuterium labeled (molecule in color in Figure 1) polymer chain after crosslinking as a function of **q**. The two solid lines represent theoretical scattering profile (Debye function) of a Gaussian coil with radius of gyration 2.8 nm and 3.2 nm respectively. The results of our measurements show that after crosslinking the polymer chain maintains its Gaussian distribution and radius of gyration (which has a value of 3.1 nm before crosslinking). The second part of the experiment is to determine how a chain deforms under external strain. Here, we would like to examine three existing models.

(1) Chain affine model: This model describes the most stringent condition, which assumes that every chain segment deforms proportionately to the macroscopic deformation. In other words, if a segment is located on the site of a three-dimensional lattice, it will deform with that site as the whole lattice dimension deforms, the segment deformation being proportional to the macroscopic deformation.

(2) Junction affine model: This is the commonly accepted model which assumes that the crosslinking points deform affinely with the macroscopic deformation. Polymer chains between two crosslinking points can relax and assume a "random walk" conformation for their end-to-end distance.

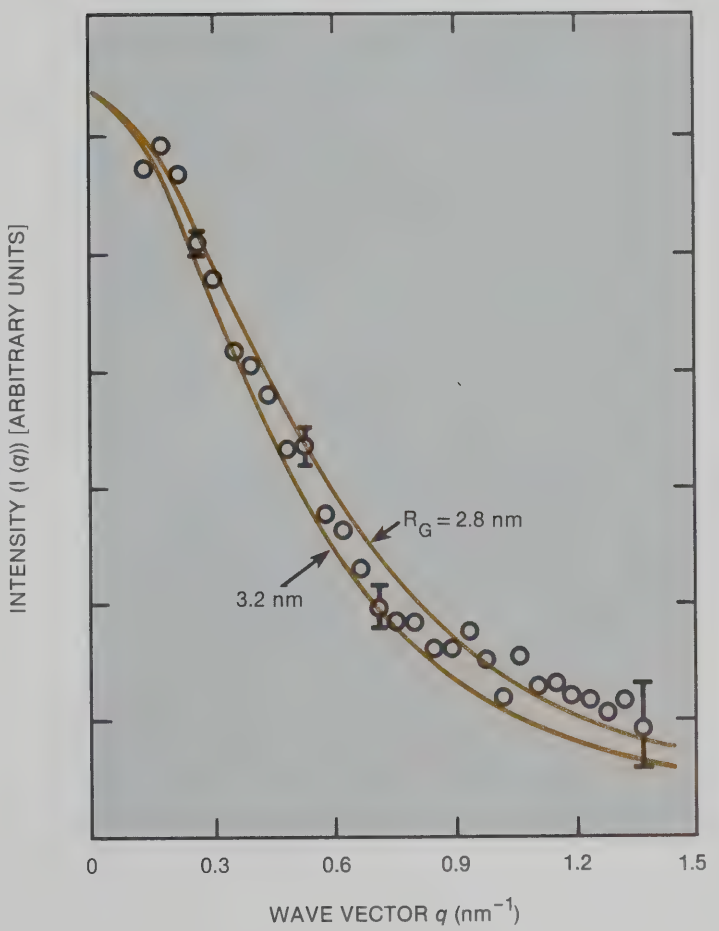



**Figure 2**—*Scattered intensity I (**q**) from deuterated polybutadiene chain after crosslinking is plotted versus scattering wave vector **q**, together with the theoretical curve of Gaussian chains with radius of gyration $R_G$ 2.8 nm and 3.2 nm.*

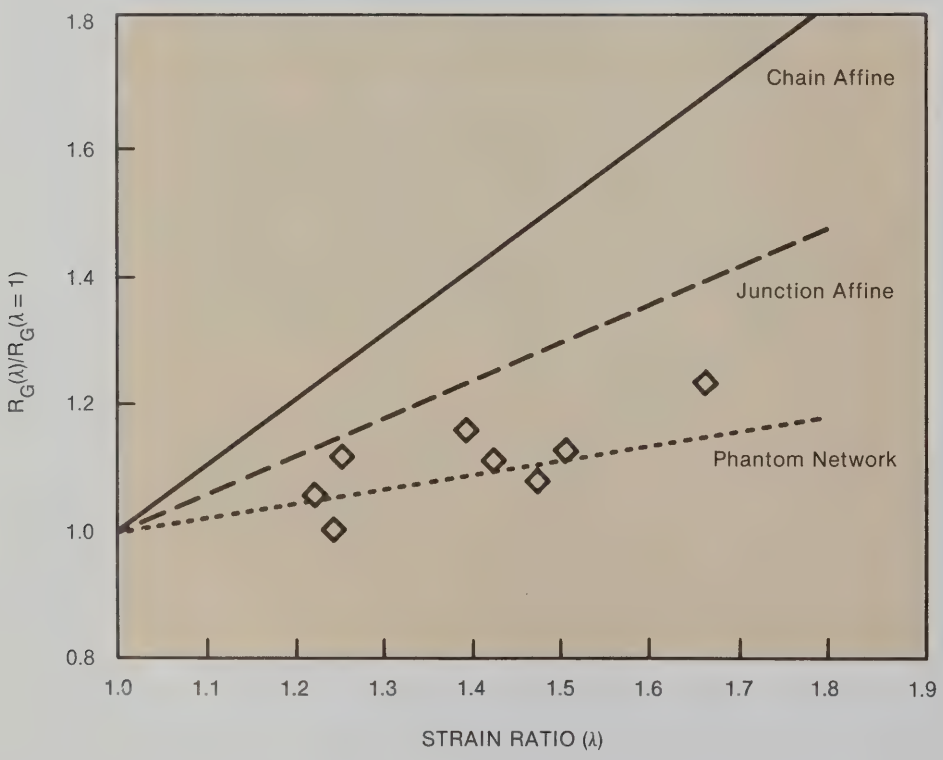
*turn page*

(3) Phantom network model: This model assumes that all of the crosslinking points and segments can redistribute to their most relaxed conditions except at the macroscopic boundaries. Thus, spatial hindrance is assumed to be minimal.

In Figure 3, we display our up-to-date results, together with the predictions of the three models described above. Although there are large uncertainties in our results, we can clearly eliminate the first model at this time.

The importance of the results of this experiment is that one can determine directly the relationship between molecular conformation and macroscopic deformation, and in turn determine material properties such as the stress-strain relationships from molecular distribution functions. We are now preparing a second stage of this experiment, which will be in collaboration with scientists at the University of Wisconsin and another group of macromolecular scientists from Strasbourg, France. Synthetic natural rubber-polyisoprene of different molecular weights will be used. With the improved SANS facility, we hope to obtain more definitive results to evaluate the existing models and possibly to carry out further theoretical developments.

**Figure 3**—*The ratio* $[R_G(\lambda)/R_G\ (\lambda = 1)]$ *of radius of gyration in the strained direction at strain ratio* $\lambda$ *(the length of strained rubber to that of unstrained rubber) is plotted against strain ratio,* $\lambda$*, together with predictions of the three models.*




## TUNGSTEN CONCENTRATE STANDARD REFERENCE MATERIAL

*The NBS Office of Standard Reference Materials announces the availability of Standard Reference Material (SRM) 277, Tungsten Concentrate. The need for such a reference material clearly was demonstrated by large discrepancies in analyses between buyers and sellers of large quantities of similar concentrates involving millions of dollars. SRM 277 (and improved methodology) should provide the means for assuring equitable buyer/seller relationships.*

Although SRM 277 is certified only for its $WO_3$ content at 67.4 (wt percent) approximate values are provided for calcium (0.37 percent), iron (7.4 percent), lead (0.07 percent), manganese (10.0 percent), molybdenum (0.06 percent), niobium (1.00 percent), phosphorus (0.03 percent), silicon (0.85 percent), sulfur (0.25 percent), tin (0.54 percent), and titanium (2.2 percent). Additional information is provided for 15 major or minor elements and 19 trace elements.

This Tungsten Concentrate, SRM 277, was prepared primarily from wolframite ores from China, Thailand, and the United States. It is, therefore, a complex material compared to the relatively "pure" wolframite or scheelite concentrates.

The issuance of this SRM is the culmination of a major Industry-ASTM-NBS cooperative program international in scope. Sixteen laboratories participated in the analytical program for certification that included nine in the U.S.A.; two each in Austria and England; and one each in Germany, India, and Sweden.

SRM 277, Tungsten Concentrate, is issued in units of 100 g and may be purchased for $83 per unit from the Office of Standard Reference Materials, Room B311, Chemistry Building, NBS, Wash., D.C. 20234.

## NEW ANALYTICAL CHEMISTRY TECHNIQUE BEING USED AT NBS: ION-CHROMATOGRAPHY

*A recent addition to the analytical tools in the National Bureau of Standards' Inorganic Analytical Research Division is an ion-chromatograph acquired commercially in January 1978, and put into operation in March. The instrument is now fully operational and has already been used to analyze several diverse types of samples ranging from oysters to air filters. Ion-chromatography has tremendous potential in the determination of previously uncertified species in presently available NBS Standard Reference Materials (such as coal and bovine liver) as well as in new materials (such as the air particulate filter strips).*

*William F. Koch, Inorganic Analytical Research Division, A225 Chemistry Building, 301/921-2883.*

Ion-chromatography is a new technique for trace chemical analysis. This analysis can include speciation—that is, the identification of different forms of an element combined with other elements. (For example, sulfur may be present in water as sulfide, sulfite, and sulfate. Ion-chromatography can distinguish among the three different forms).

The technique, a form of liquid chromatography, involves the separation of the ionic constituents of a sample in solution on a glass chromatography column packed with ion-exchange resin. Once separated, the different ions are detected by an electro-chemical detection system, specifically a flow-through conductivity meter. The amount of electrical conductivity exhibited by the meter is proportional to the concentration of the ions in the solution. The normally high background conductance associated with the eluent (the solution which carries the sample through the columns and detector) is made negligible through use of a suppressor resin column.

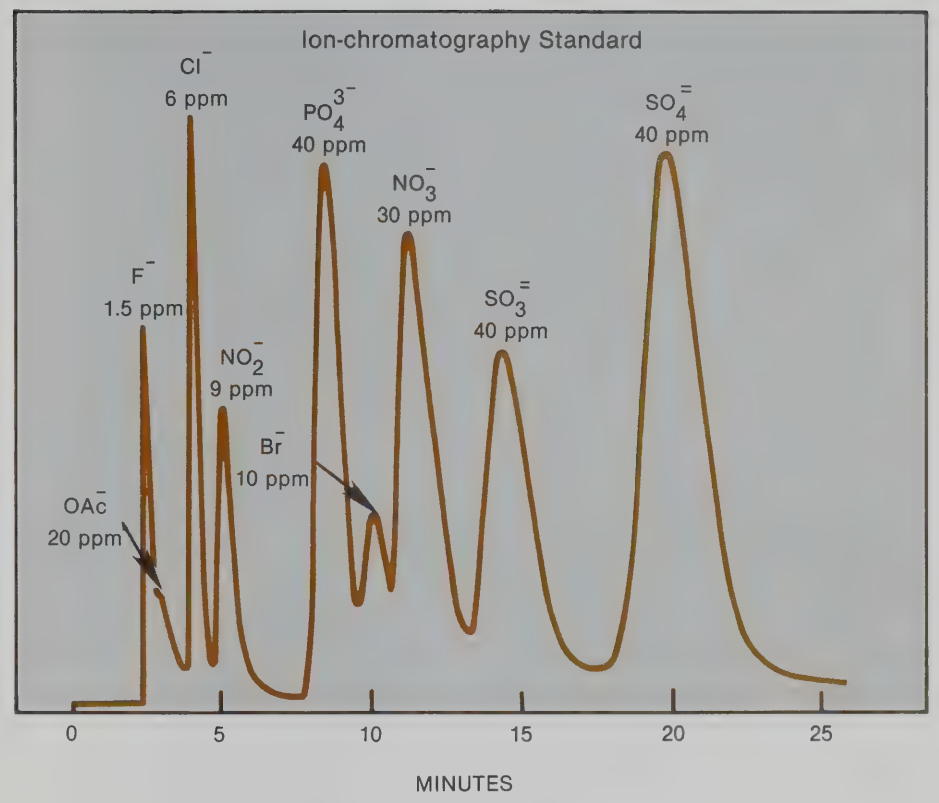



**Figure 1**—*Ion chromatogram of a standard solution of nine anions under standard conditions.*

In experiments at NBS, beginning in March 1978, ion-chromatography has already shown great promise in solving complex trace analytical problems, particularly in speciating and measuring substances which exist in, or can be converted to, anionic form. It is ideally suited for inorganic anions, but can also be applied to low molecular weight organic acids as well as to some cations, such as sodium and potassium. The potential of ion-chromatography to determine several species in a sample simultaneously is especially important for the field of microanalysis.

A typical analysis of a suitably prepared sample containing fluoride, acetate, chloride, nitrite, phosphate, bromide, nitrate, sulfite, and sulfate, takes about 25 minutes (Figure 1). The minimum detection limit for these common anions under standard conditions is about 0.5 ppm (by weight) with a precision of 1 to 3 percent. The minimum detection limit can be extended 10 to 100-fold through use of larger sam-

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**Figure 2**—*Chromatograms of the soluble anions in oyster tissue and of a standard solution. Standard conditions. Scale mode, logarithmic.*

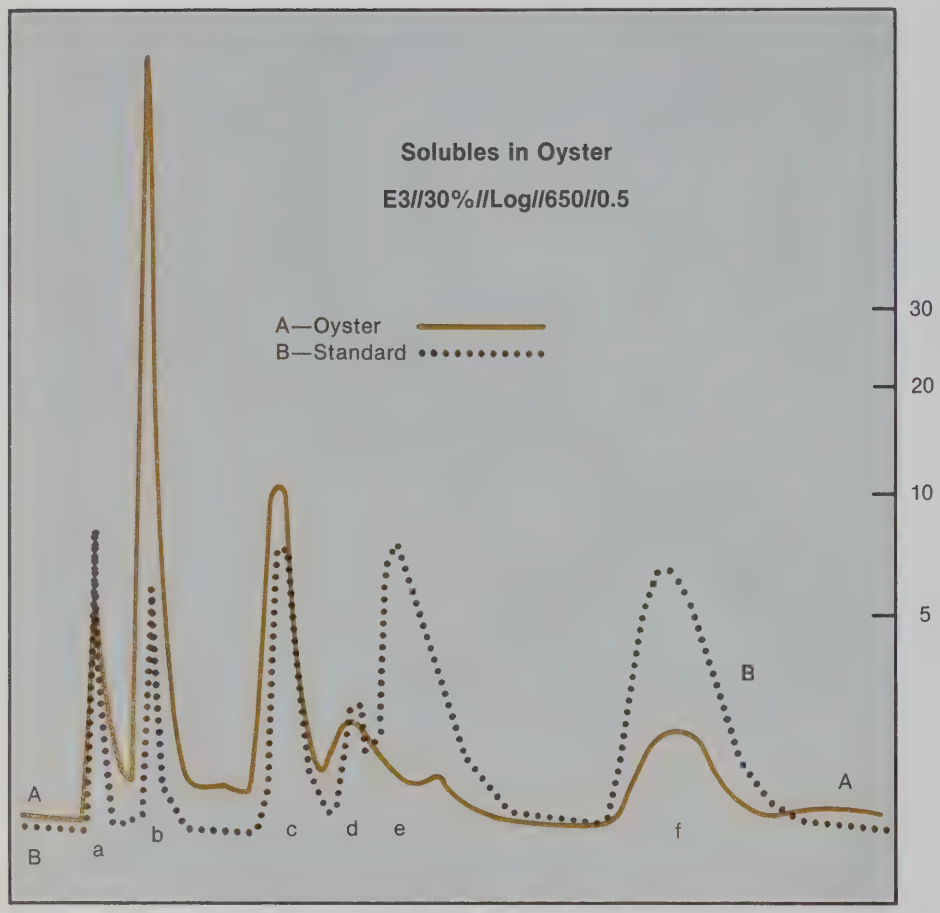


**Table 1**

**Solubles in Oysters:**

Peak Identification and Approximate Concentration

| Peak | Probable Species | Approximate Concentration |
|---|---|---|
| a | $F^-$ | <0.02% |
| b | $Cl^-$ | 1.10% |
| c | $PO_4^{3-}$ | 0.70% |
| d | $Br^-$ | <0.09% |
| e | $NO_3^-$ | <0.13% |
| f | $SO_4^=$ | 0.19% |

ple loops or concentrator columns. Current research indicates that under somewhat different chromatographic conditions, iodide can also be determined with a minimum detection limit of about 0.2 ppm.

Aqueous samples, such as rain water, fresh water, and sea water, may be analyzed with little or no preparation; solids must be solubilized, generally by standard microchemical techniques (dissolution, sonication, extraction, fusion, digestion, or combustion). We are doing extensive research in this laboratory in optimizing sample preparation methods and chromatographic parameters for simultaneous multi-species analyses in real samples.

To date, the samples we have analyzed by ion-chromatography include lyophilized oyster tissue, mechanical packing products, glass fiber filters, penetrant inspection materials, and waste oil.

The scope of the oyster project was to detect and determine the levels of concentration of as many anionic species as possible in lyophilized oyster tissue. Both the anions soluble in water and the anions resulting from a suitable combustion technique were studied. For the solubles, six peaks were detected and identified via a standard solution. Determining levels of concentration was possible only on a very approximate basis for the solubles (Figure 2, Table 1). Very reliable quantitative information on chloride and sulfur was obtained after combustion of the oyster tissue in a Schöniger oxygen flask (Figure 3, Table 2).

Leachable chlorides have been determined in mechanical packings (teflon-asbestos or graphite-asbestos composites) at the 10-100 ppm level. Nitrate and sulfate on glass fiber filters were determined for use as standards in air-particulate analysis (Table 3). Penetrant inspection materials used to detect faults in steel welds were analyzed for fluoride and chloride in conjunction with an ASTM Round-Robin. These materials were combusted in a Parr oxygen bomb prior to analysis. The level of chloride in 14 different samples ranged from 3 to 1800 ppm,

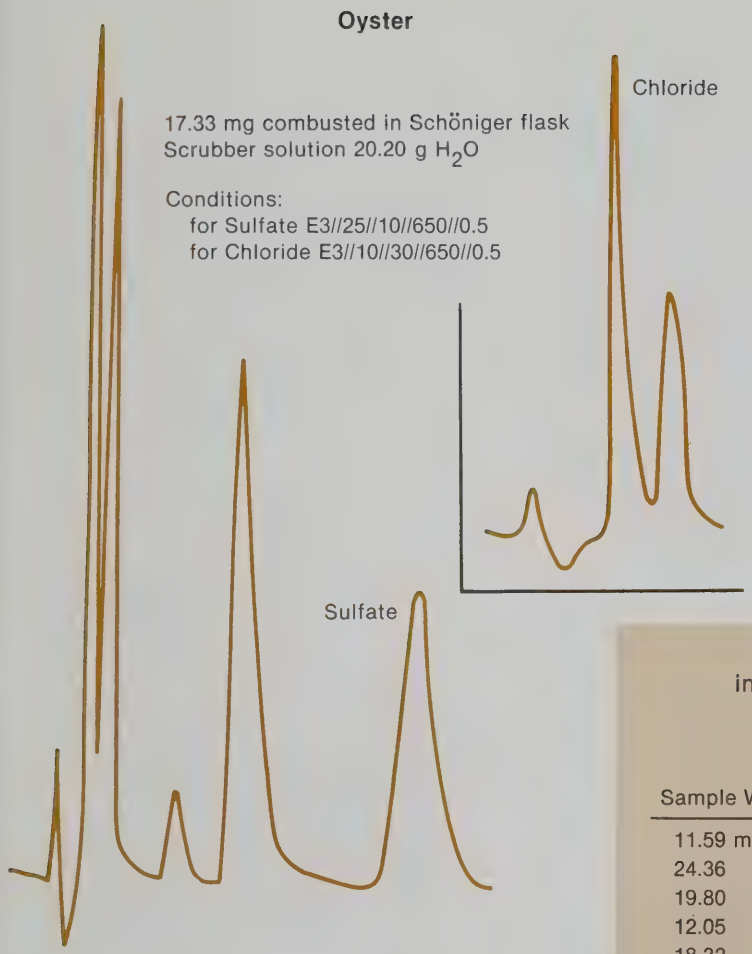


**Figure 3**—*Chromatograms of oyster tissue after a Schöniger flask combustion. Standard conditions for sulfate, reduced flow rate for chloride.*

and fluoride from 0.5 to 200 ppm. Waste oil has also been analyzed by ion-chromatography for chloride and bromide after digestion by the sodium alcoholate method.

The results obtained to date at NBS with the ion-chromatograph indicate that it could be used to determine as yet uncertified species in current Standard Reference Materials, including the coal and bovine SRM's. New materials now being developed, such as the air-particulate filter strips, might also be certified for a wider spectrum of constituents if ion-chromatography is used. These and other possibilities are now being explored.

**Table 2**

Chloride and Sulfur (as Sulfate) Concentrations in Oyster SRM as Determined by Ion-Chromatography after Schöniger Flask Combustion

| Sample Wt. | Scrubber Soln. Wt. | Chloride | Sulfate |
|---|---|---|---|
| 11.59 mg | 20.10 g | 1.034% | 2.201% |
| 24.36 | 20.07 | 1.032 | 2.259 |
| 19.80 | 20.00 | 1.057 | 2.244 |
| 12.05 | 19.99 | 1.010 | 2.253 |
| 18.32 | 19.99 | 1.037 | 2.258 |
| 17.33 | 20.20 | 1.051 | 2.278 |
| 26.67 | 19.99 | 1.038 | — |
| 20.11 | 20.02 | 1.013 | 2.300 |
| | Mean | 1.034% | 2.256% |
| | Std. Dev. | 0.016 | 0.031 |
| | Rel. Std. Dev. | 1.6 % | 1.4 % |

**Table 3**

Analysis of Filter Strips for Nitrate and Sulfate by Ion-Chromatography

| Series | Nitrate Mean (S.D.) (R.S.D.) | Sulfate Mean (S.D.) (R.S.D.) |
|---|---|---|
| II-BL | 1.5 μg (1.0) | 2.3 μg (1.5) |
| II-A | 100.3 μg (2.6) (2.6%) | 502.6 μg (8.9) (1.8%) |
| II-B | 1002.0 μg (16.0) (1.6%) | 2002.0 μg (29.0) (1.5%) |
| II-C | 2513.0 μg (43.0) (1.7%) | 6939.0 μg (109.0) (1.6%) |

# CONFERENCES

For general information on NBS conferences, contact JoAnn Lorden, NBS Public Information Division, Washington, D.C. 20234, 301/921-2721.

## BUILDING SECURITY SYMPOSIUM

American Society for Testing and Materials/National Bureau of Standards symposium, "Building Security," will be held at NBS in Gaithersburg, MD., during the week of April 3-4, 1979. ASTM Committee F-12 on Security Systems and Equipment is sponsoring the meeting in conjunction with NBS.

The symposium will examine the subject of building security in detail to determine the current state of the art, identify its weaknesses, and lay the groundwork for the development of standards and guidelines.

The three sessions that will be covered are:
1) crime prevention and designers; 2) security in codes and standards; and 3) security equipment and services. There will be a panel workshop in addition to those workshops on building security.

For further information contact George Stevenson, ASTM, 1916 Race St., Philadelphia, PA 19103, 215/299-5504 or John Stroik, Symposium Chairman, Environmental Design Research Division, CBT, NBS, Washington, D.C. 20234, 301/921-2107.

## ULTRASOUND CHARACTERIZATION SYMPOSIUM

The Fourth International Symposium on Ultrasonic Imaging and Tissue Characterization will be held June 18-20, 1979 at the National Bureau of Standards in Gaithersburg, Md.

The symposium will feature talks on state-of-the-art developments, new directions of technology, and research opportunities in ultrasonic imaging and characterization of tissues. A tutorial session on scattering will be given on the afternoon of June 17 preceding the symposium.

Cosponsored by NBS and the National Institutes of Health, the meeting will provide doctors, engineers, physical scientists, and mathematicians an opportunity to discuss new advances in this important developing area of medical diagnosis.

Sessions will be devoted to:

—techniques for measuring ultrasonic properties of tissue (velocity, attenuation, absorption, scattering, impedance)

—imaging techniques, including transducer and array technology

—computerized tomography

—signal processing and pattern recognition

—Doppler techniques

—microscopy

—ultrasonic characteristics of tissue and their dependence on physical and biological variables (e.g., ultrasonic frequency, temperature)

—equipment standardization and calibration

—tissue phantoms

Persons interested in presenting a paper at the symposium should submit a 500-word abstract by March 1 to chairperson. Prospective speakers will be notified around mid-April as to whether their papers have been approved for presentation.

For further information contact: Dr. Melvin Linzer, symposium chairperson, A366 Materials Building, NBS, 301/921-2858.

## JOINT CRYOGENIC ENGINEERING AND MATERIALS CONFERENCES

Papers are now being solicited for the Joint 1979 Cryogenic Engineering and International Cryogenic Materials Conferences to be August 12-14, 1979, at the University of Wisconsin in Madison.

The combined conferences are sponsored by the Cryogenic Engineering Board and arranged by the National Bureau of Standards and the University of Wisconsin. The conferences will have parallel programs for those who have common interests in applying cryogenic techniques and materials to the problems of the future.

The Cryogenic Engineering Conference (CEC) will have as its theme "Cryogenics —Opportunities for the Future." The scope of the CEC will include all aspects of cryogenic engineering, such as:

—Applications of superconductivity

—Low temperature and SC magnet engineering

—Refrigeration and liquefaction technology

—LNG processes and technology

—Applications of liquid hydrogen

—Fundamentals: thermodynamics, fluid properties, heat transfer, fluid mechanics

—Instrumentation

—Applications in food and health industries

—Energy recovery/conservation

—Applications for the future

The scope of the International Cryogenic Materials Conference (ICMC) will include all aspects of material technology and material properties at low temperatures, specifically:

—Superconductors and their properties

—Structural and superconducting composites

—Structural metals, alloys, and polymers

—Insulators, seals, and lubricants

—Materials engineering and future applications

There will be two types of presentations during the 1979 combined conference: papers delivered during the regular sessions and limited to approximately 25 minutes, and poster presentations. During poster sessions, the first hour will be limited to authors presenting two or three minute abstracts of their papers. Time for this delivery will be rigidly kept, and no questions will be permitted. At the conclusions of the oral presentations, the speakers and the audience will adjourn to poster boards for in-depth discussions. Authors of both papers and poster presentations will receive more specific instructions prior to the conference.

All abstracts which are accepted will appear in the conference program, and it is expected that manuscripts of all presentations will be submitted for review and possible publication in the Conference Proceedings. Both oral and poster papers will be treated exactly the same with respect to publication.

Acceptance of papers does not guarantee publication in the proceedings. Papers and poster presentations will be selected on the basis of quality and relevancy by the editors for publication in Advances in Cryogenic Engineering, Vol. 25, (CEC) Vol. 26 (ICMC). The final publication must be limited to about 2500 words with eight figures or tables.

Attendees at the 1979 conference will elect three new members to fill expiring terms on the Cryogenic Engineering Conference Board. Candidates for the Board are nominated by petition of attendees of former Cryogenic Engineering Conferences for industrial, governmental, and educational organizations.

Persons interested in presenting a paper at the regular session or the poster session should submit five copies of the abstract and preliminary manuscript by March 1, 1979 to: CEC—Thomas M. Flynn, Division 736, National Bureau of Standards, Boulder, Colorado 80303; ICMC—R. P. Reed, Division 736, National Bureau of Standards, Boulder, Colorado 80303.

For any additional information regarding the CEC, contact Mrs. Dee Belsher, Conference Administrator, National Bureau of Standards, Boulder, CO 80303, 303/499-1000 ext. 3244.

# CONFERENCE CALENDAR

April 2-4
TEMPERATURE COMPENSATION IN THE MEASUREMENT OF PETROLEUM PRODUCTS, NBS, Gaithersburg, MD; sponsored by NBS and NCWM; contact: Harold Wollin, A211 Metrology Building, 301/921-3677.

April 4-5
SYMPOSIUM ON BUILDING SECURITY, NBS, Gaithersburg, MD; sponsored by NBS and ASTM; contact: John Stroik, A355 Building Research Building, 301/921-2107.

* April 9-10
CONFERENCE ON NEUTRON RADIATION PLANNED, NBS, Gaithersburg, MD; sponsored by NBS, BRH, and AAPM; contact: Henry Heaton, C229 Radiation Physics Building, 301/921-2551.

April 19-20
5TH ROOFING TECHNOLOGY CONFERENCE, NBS, Gaithersburg, MD; sponsored by NBS and NCRA; contact: Robert G. Mathey, B358 Building Research Building, 301/921-2407.

* May 14-16
FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER, SEMI-ANNUAL MEETING, NBS, Gaithersburg, MD; sponsored by NBS and the Federal Laboratory Consortium; contact: James Wyckoff, A400 Administration Building, 301/921-3814.

May 17
TRENDS AND APPLICATIONS SYMPOSIUM, NBS, Gaithersburg, MD; sponsored by NBS and IEEE; contact: Shirley Watkins, B212 Technology Building, 301/921-2601.

May 21-22
WORKSHOP ON THERMAL ANALYSIS, NBS, Gaithersburg, MD; sponsored by NBS and the University of Akron; contact: Oscar Menis, B326 Chemistry Building, 301/921-2175.

** May 23-25
MECHANICAL FAILURES PREVENTION GROUP, NBS, Gaithersburg, MD; sponsored by NBS and MFPG; contact: Harry Burnett, B264 Materials Building, 301/921-2813.

June 4-6
INTERNATIONAL CONFERENCE ON SYNCHROTRON RADIATION INSTRUMENTATION, NBS, Gaithersburg, MD; sponsored by NBS, Brookhaven National Laboratory, Stanford University, University of Wisconsin, Cornell University; contact: David Edwin, A251 Physics Building, 301/921-2031.

June 11-15
SYMPOSIUM ON ACCURACY IN POWDER DIFFRACTION, NBS, Gaithersburg, MD; sponsored by NBS, National Research Council of Canada, and the International Union of Crystallography; contact: Stanley Block, A219 Materials Building, 301/921-2837.

June 18-20
FOURTH INTERNATIONAL SYMPOSIUM ON ULTRASONIC TISSUE CHARACTERIZATION, NBS, Gaithersburg, MD; sponsored by NBS and NIH, contact: Melvin Linzer, A329 Materials Building, 301/291-2858.

* June 21
18TH ANNUAL ACM TECHNICAL SYMPOSIUM, NBS, Gaithersburg, MD; sponsored by NBS and ACM; contact: Seymour Jeffery, A247 Technology Building, 301/921-3531.

* July 22-27
NATIONAL CONFERENCE ON WEIGHTS AND MEASURES, Red Lion Motor Inn, Portland, Oregon; sponsored by NBS and NCWM; contact: Harold Wollin, A211 Metrology Building, 301/921-3677.

* September 5-7
SYMPOSIUM ON EDDY CURRENT NONDESTRUCTIVE TESTING, NBS, Gaithersburg, MD; sponsored by NBS, ASTM and ASNT, contact: George Birnbaum, A363 Materials Building, 301/921-3331.

** New Listings.*
***April 16-18 postponed to May 23-25.*

# PUBLICATIONS

## TEACHER AIDS

*by Stan Lichtenstein*

The following materials produced by agencies of the Federal Government are recommended by DIMENSIONS/NBS for their potential value to educators as supplements to the classroom or school library.

*Isotopes in Environmental Control*

A 17-minute, 16-mm color film produced in 1971, showing ways in which radioactive atoms are being used in the preservation or restoration of the human environment. Purchase price, $98.50, but for information on loans contact:
Department of Energy
TIC Film Library
Oak Ridge, TN 37830

*Source Book of Educational Materials for Medical Radiographers*

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*Asbestos: An Information Resource*

This monograph, prepared by Stanford Research Institute International for the Department of Health, Education, and Welfare's National Cancer Institute, devotes 105 pages of well-organized narrative to the subject. It covers asbestos in industry (mining, milling, transportation, manufacturing), biological effects of asbestos fibers, occupational and non-occupational exposures, and asbestos hazard controls—physical and medical. Eight appendices provide extensive documentation and bibliographic material. The introductory chapter opens with interesting historical notes about asbestos as used by the ancient Greeks and Romans and by Charlemagne, then quickly proceeds to a comprehensive outline of the uses and dangers of asbestos today. Single copies free. Send requests for DHEW Publication No. NIH/78-1681 to:
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Bethesda, MD 20014

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## INTERNATIONAL CATALOG LISTS COMBINED ENERGY-SAVING UTILITY SYSTEMS

International Project Catalog of Modular Integrated Utility Systems, Nimmo, M. H., Phillips, C. W., Nat. Bur. Stand. (U.S.), Spec. Publ. 515, 455 pages (July 1978) Stock No. 003-003-01953-4, $6.50.*

More than 200 projects that combine various types of essential residential utility services into one energy-conserving utility package are described in a new catalog published by the National Bureau of Standards for an international energy organization.

The catalog lists Modular Integrated Utility Systems (MIUS)-type projects, systems which provide an option to package into a single processing plant two or more of the six utility services necessary for community development. These services are electricity, space heating and water heating, air conditioning, solid waste processing, wastewater treatment, and residential water purification. MIUS-type projects are designed to recover energy. that would typically be wasted by larger-scale conventional systems, and are expected to minimize the environmental impact of utility systems.

The projects were selected from 12 of the countries participating in a special MIUS program organized by the Committee on the Challenges of Modern Society (CCMS), a North Atlantic Treaty Organization group. The CCMS-MIUS project has been led by the United States under the sponsorship of the U.S. Department of Housing and Urban Development. NBS provides technical assistance to the project.

There are numerous MIUS-type projects either planned, in progress, or in operation. The catalog is intended to foster an exchange of information about actual MIUS experience and future plans.

Each of the 200 entries in the catalog includes details about the project approach, its status, expected results, some technical data, and the principal investigator. It also indicates whether or not data about the facility's performance is or will be available in the future.

## MEASURES FOR AUTOMATIC DATA PROCESSING SYSTEMS

*Considerations in the Selection of Survey Measures for Automatic Data Processing Systems, Orceyre, M. J., Courtney, R. H., Jr., and Bolotsky, G. R., Nat. Bur. Stand. (U.S.), Spec. Publ. 500-33, 33 pages (June 1978) Stock No. 003-003-01946-1, $1.40.*

This report introduces the readers to currently known methods and techniques for protecting data in an ADP facility and during transmission. The material is presented as an aid in evaluating and selecting security measures following the identification of existing risks and potential losses via a risk analysis.

### Building Technology

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# NEWS BRIEFS

ACCORD WITH SOVIET ACADEMY OF SCIENCES. The National Bureau of Standards has signed a memorandum of cooperation with the Soviet Academy of Sciences providing for the exchange of scientific personnel and information in the fields of thermal physics, thermodynamics, materials science, spectroscopy, chemistry, chemical kinetics, and cryogenic science. Other fields may be added by mutual consent. NBS is the only U.S. organization other than the National Academy of Sciences that has such an agreement with the Soviet Academy.

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LATENT FINGERPRINT MATCHING. A new NBS report describes a procedure for automatically determining if a latent scene-of-crime fingerprint matches a fingerprint on file. The work was sponsored by the FBI. The report, The LX39 Latent Fingerprint Matcher (NBS Special Publication 500-36), is paperback, 18 pages. Order from U.S. Government Printing Office, Wash., D.C. 20402, SD Stock No. 003-003-01958-5, $1.10.

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STANDARD URBAN DUST. A new Standard Reference Material (SRM) from NBS, representing a large homogeneous quantity of urban dust, will aid environmental researchers. This SRM was prepared from urban particulate matter collected in the St. Louis, MO., area over a 12-month period. SRM 1648, Urban Particulate Matter, is available for $88 from the Office of Standard Reference Materials, NBS, Wash., D.C. 20234.

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HIGH TEMPERATURE THERMOMETER. Scientists from NBS and its Italian equivalent, the Instituto di Metrologia "G. Colonetti" of Turin, have been developing a new high temperature thermometer that may replace the present international standard for the range 630-1064 C. Based on an NBS design, the new thermometer is expected to be 20 times more accurate than the existing standard. Other collaborating institutions include the national standards labs of France and Japan.

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FY 1980 BUDGET REQUEST. A total of $96 489 000 is included for NBS in the Budget of the United Sates for Fiscal Year 1980, which was submitted to Congress by President Carter on January 22. This request is $9 945 000 above NBS' operating level of $86 544 000 for FY 1979. Other agency funding is not included in these amounts. A more detailed breakdown of funding will appear in the next issue of DIMENSIONS/NBS.

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